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Title: RCT Continuing Training: 1st Quarter 2022

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Intended for: RCT Continuing Training

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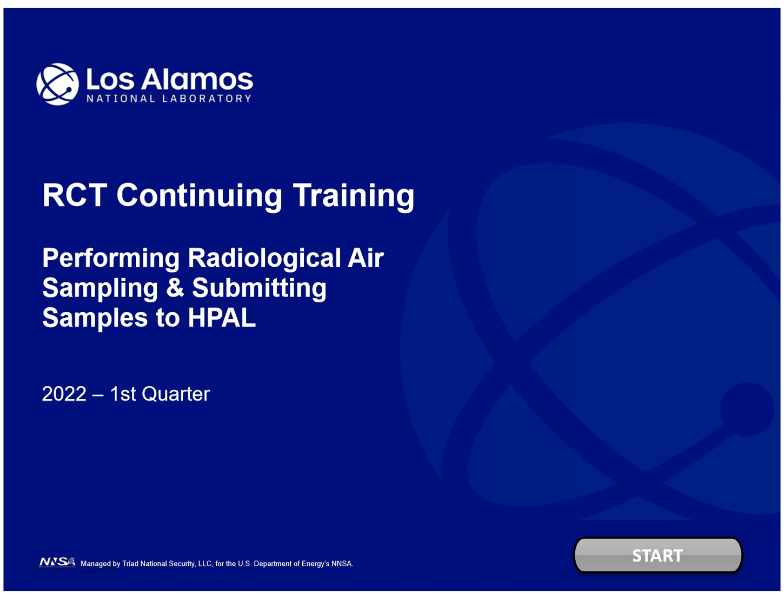
RCT Continuing Training: 1st Quarter 2022

1. RCT Continuing Training 2022 1st Quarter

1.1 RCT Continuing Training

Performing Radiological Air Sampling & Submitting

Samples to HPAL



1.2 Introduction

Introduction

Welcome to RCT Continuing Training.
This training will discuss the process for:

1. Collecting and Evaluating Radiological Air Samples
2. Submitting Samples to HPAL

This training consists of viewing the online presentation and completing its associated exercise guide, UTrain Course #53850. It is recommended that you have the exercise guide with you while following along with the online training.

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1.3 Terminal Objectives

Terminal Objectives

TO1: Given the need to perform radiological air sampling, recognize the requirements of P121, *Radiation Protection* and RP-PROG-TP-200, *Radiation Protection Manual.*

TO2: Given the need to submit radiological samples to HPAL, recognize the requirements of P121, *Radiation Protection* and RP-PROG-TP-205, *Submitting Samples to HPAL.*

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1.4 Enabling Objectives

Enabling Objectives

EO1: Describe the process to perform an air sampler filter change

EO2: Explain the operation of a Lo-Vol “Giraffe” air sampler

EO3: Describe the process of an air sampler flow-rate verification

EO4: Identify the considerations for air sampler placement

EO5: Calculate DAC given HPAL air sample results

EO6: Document air sample results

EO7: Describe the process for submitting samples to HPAL

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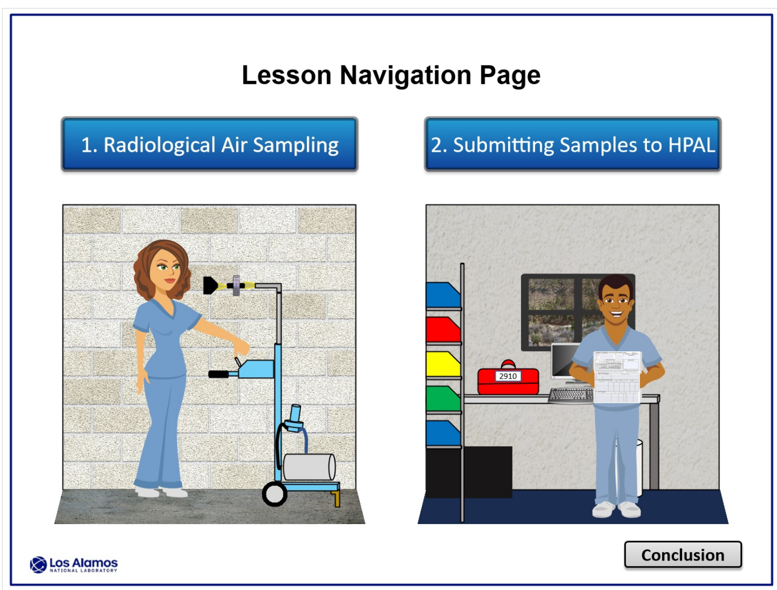
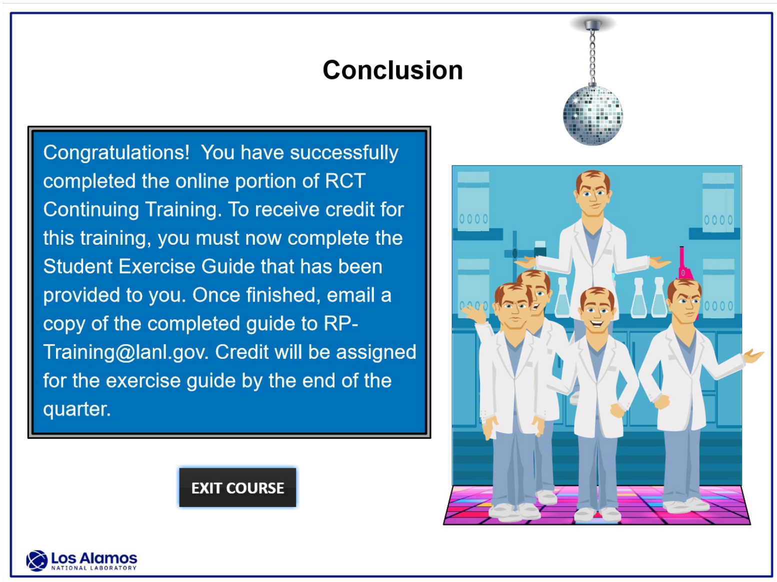
1.5 Lesson Navigation Page

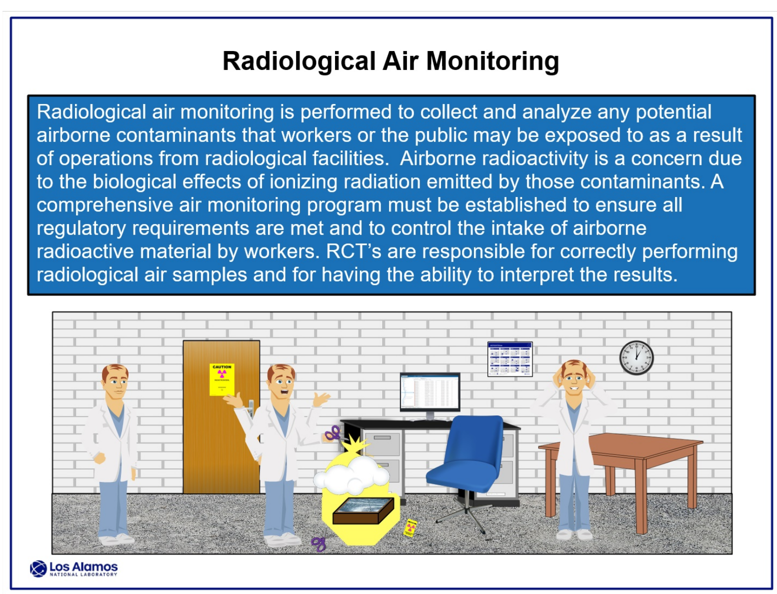


1.6 Conclusion



2. Radiological Air Sampling

2.1 Radiological Air Monitoring

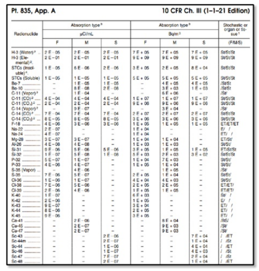


2.2 Air Monitoring Program

Air Monitoring Program

The primary objectives of an air monitoring program include:

- Measuring the concentration of the radiological contaminants in the air
- Identifying the types and characteristics of the contaminants
- Evaluating any potential hazards to the workers from the airborne contaminants present
- Evaluating the performance of control measures set in place (Respirators, HEPA)
- Assessing the data to determine if bioassays are necessary



Air monitoring helps determine if the level of protection provided to the workers is sufficient to minimize internal dose received from airborne radioactive contaminants.

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Notes:

2.3 Terminology

Airborne Radioactivity Terminology

The inhalation of radioactive particles is the largest cause of internal dose in workplace incidents. Measuring airborne radioactivity is necessary to ensure that control measures are initially effective and remain effective throughout a job evolution. Regulations govern the allowable effective dose equivalent to an individual. The effective dose equivalent is determined by combining the external and internal dose equivalent values.

Annual Limit on Intake (ALI) - The quantity of a single radionuclide that, if inhaled or ingested in 1 year, would irradiate a person, represented by a reference man, to the limiting value for control of occupational exposure – a committed effective dose (CED) of 5 rem.

Derived Air Concentration (DAC) – The concentration of a radionuclide in air, which if breathed over a period of a work year, would result in the ALI for that radionuclide being reached. The DAC is obtained by dividing the ALI by the volume of air (2400 m3) breathed by an average worker during a working year.

Derived Air Concentration – hour (DAC-hr) – The product of concentration of radioactive material in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the time of exposure to that radionuclide, in hours.

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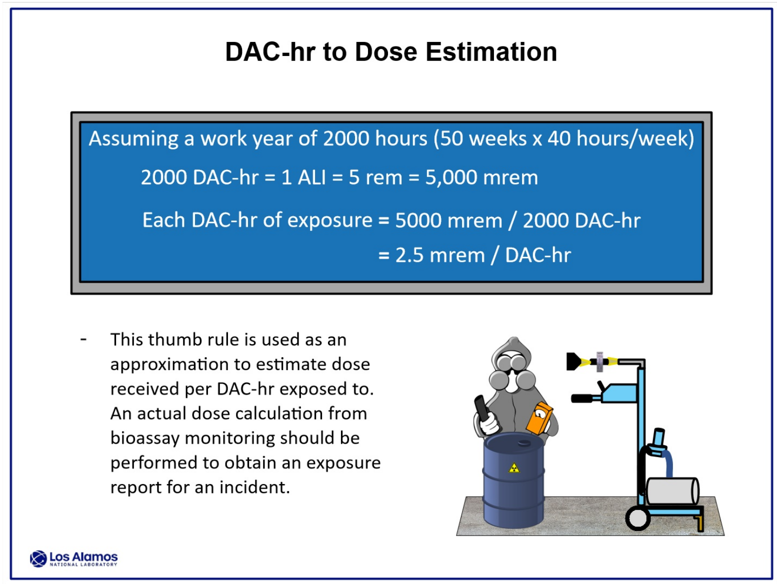
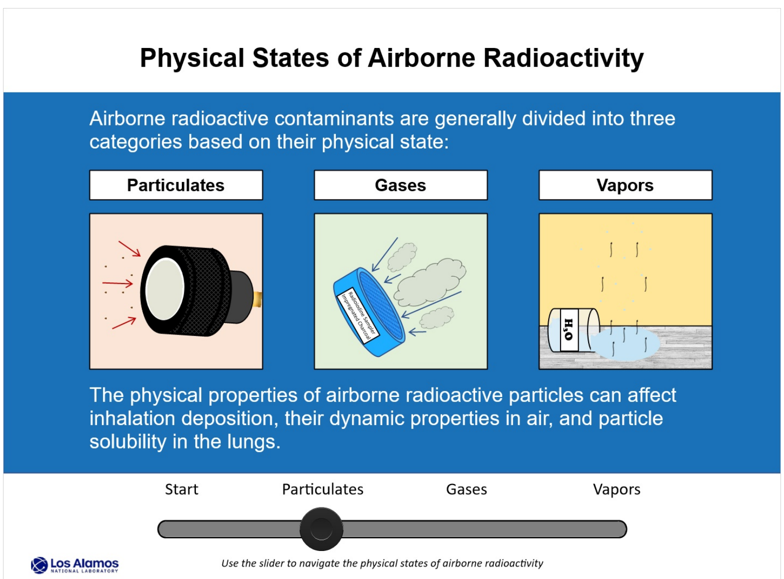
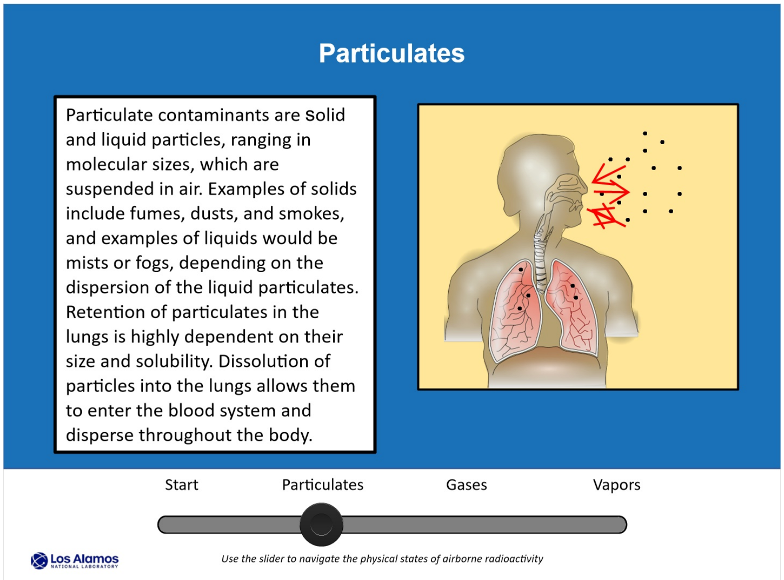
2.4 DAC-hr to Dose Estimation



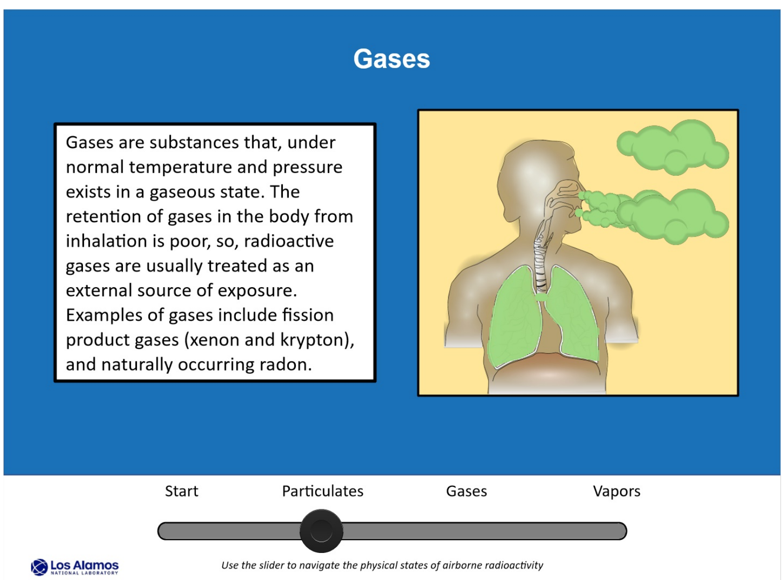
2.5 Physical States of Airborne Radioactivity



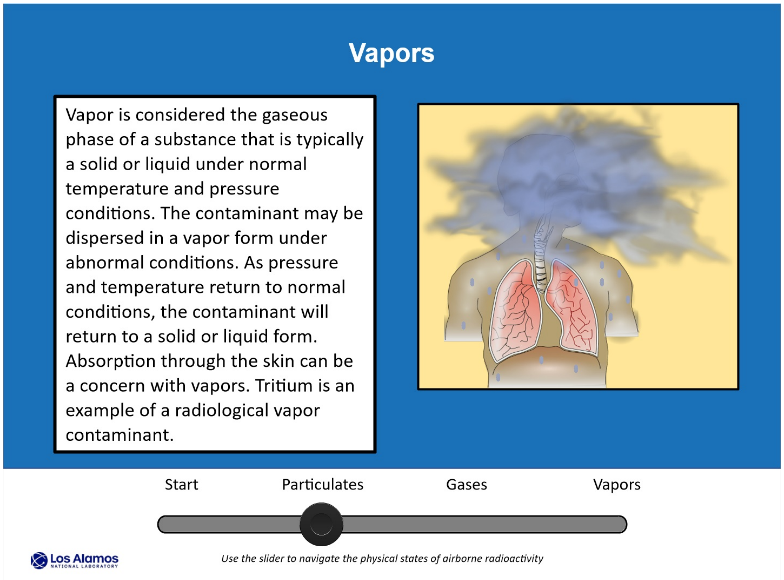
Particulates (Slide Layer)



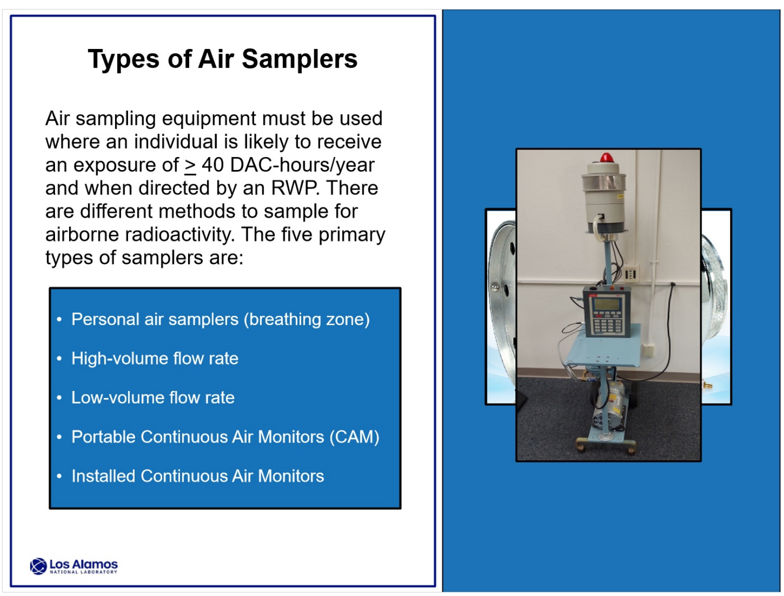
Gases (Slide Layer)



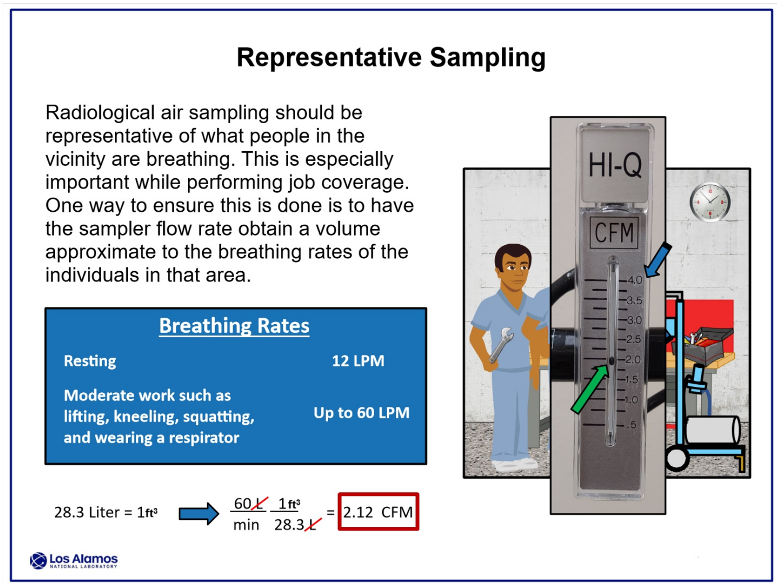
Vapors (Slide Layer)



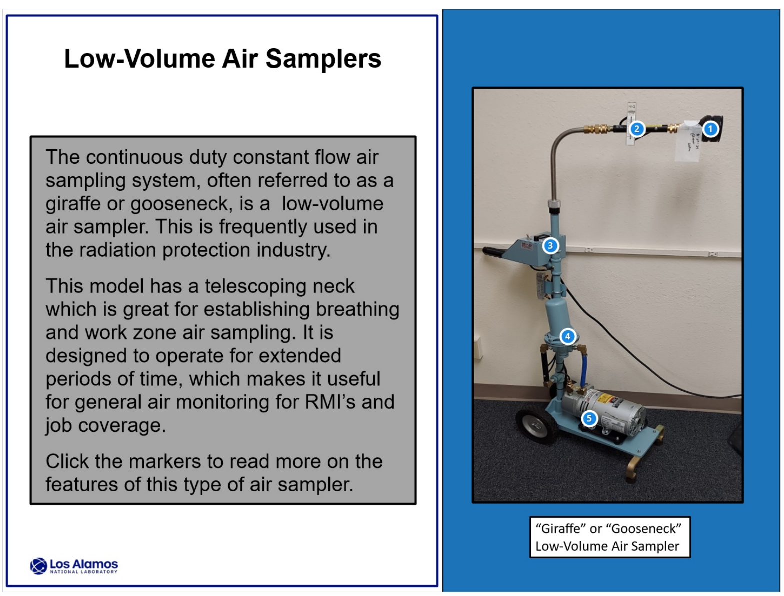
2.6 Types of Air Samplers



2.7 Representative Sampling



2.8 Low-Volume Air Samplers



2.9 Portable Continuous Air Monitors

AMS-4 Beta CAM

Portable Continuous Air Monitors

Continuous air monitors provide real-time monitoring to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material.

These real-time air monitors must have an alarm capability and enough sensitivity to alert potentially exposed individuals that immediate action is required to minimize or terminate inhalation exposures.

The Canberra Alpha Sentry and AMS-4 Beta CAMs are examples of continuous air monitors used at LANL.

2.10 Air Monitor Placement Determination

Air Monitor Placement Determination

RP-PROG-TP-200, 624.3

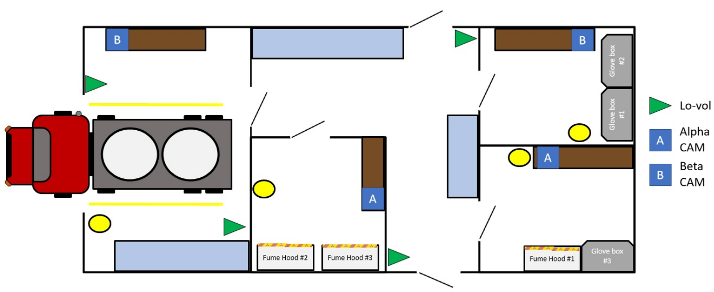
1. An air monitor placement determination is required when documenting baseline permanent air monitoring configurations.
2. If air monitoring is required in an RWP, then air monitor placement must be documented in the RWP package.
3. Consider the following when selecting the location and number of air samplers/monitors:

- Size of the area or facility
- Type of operations conducted at the facility
- Contamination levels and potential for contamination
- Traffic patterns
- Air flow patterns
- Facility features (ventilation intake locations, exhaust registers)
- Locations with high source-term potential
- Historical air monitoring results

2.11 Size of the Area or Facility

Size of the Area or Facility

The size of an area or facility is a factor due to the potential for needing multiple air samplers to get an accurate representation of the area. Consider the map below. Two low-volume air samplers are in the truck bay as well as a beta CAM. This can be due to different requirements from a job specific RWP, an RMI, or a FRPR. Having just one running in that area may not be sufficient for the given area and work being performed.



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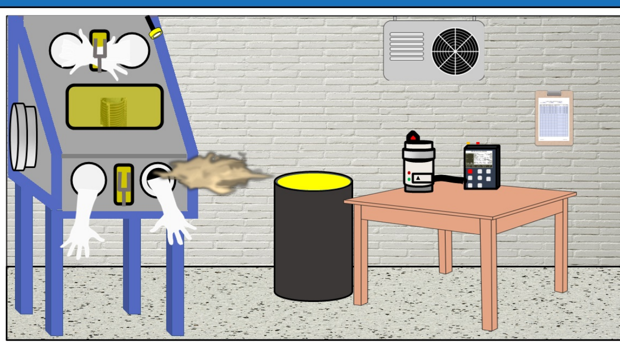
2.12 Operations Conducted

Operations Conducted at the Facility

The operations conducted at a facility will determine what type of air sampling is required. In order to capture and analyze a representative air sample, an instrument that has the capability to collect the specific type of radioactivity must be used (alpha, beta). Working with alpha contamination would require an Alpha Sentry CAM while being at a facility that deals with radioiodine would require an air sampler with an iodine cartridge.



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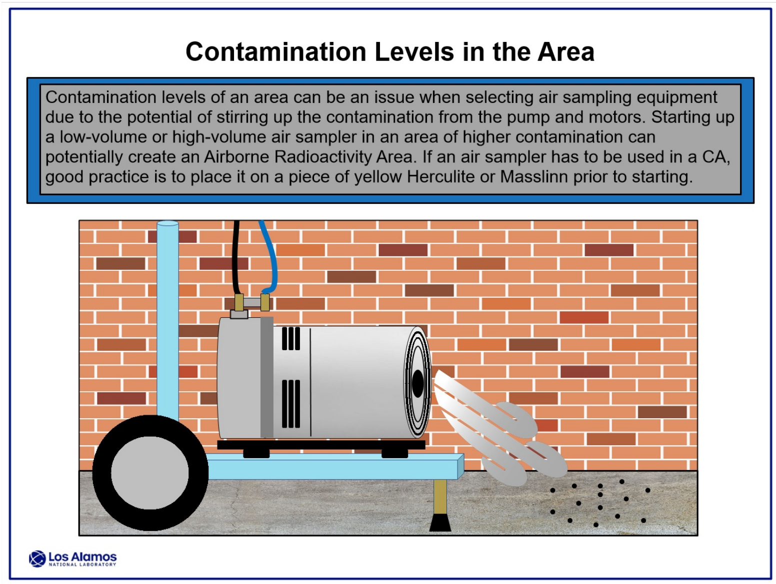
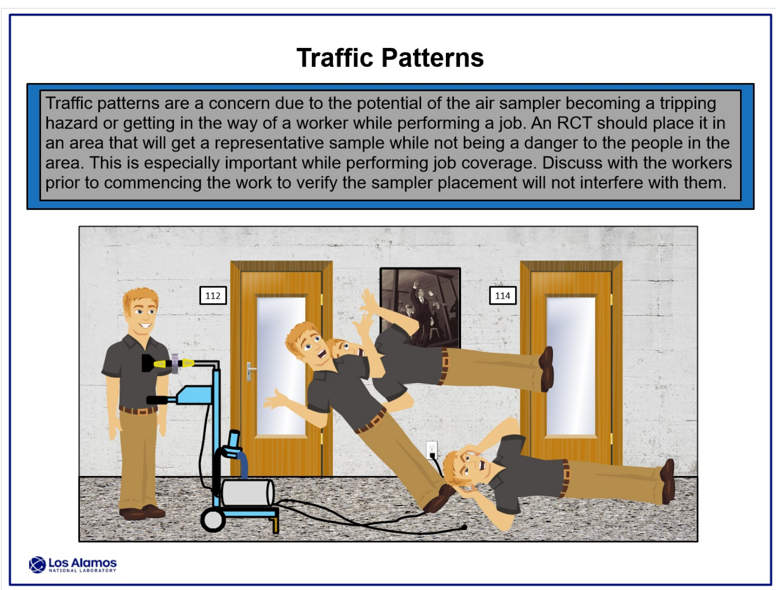
2.13 Contamination Levels in the Area



2.14 Traffic Patterns



2.15 Airflow Patterns

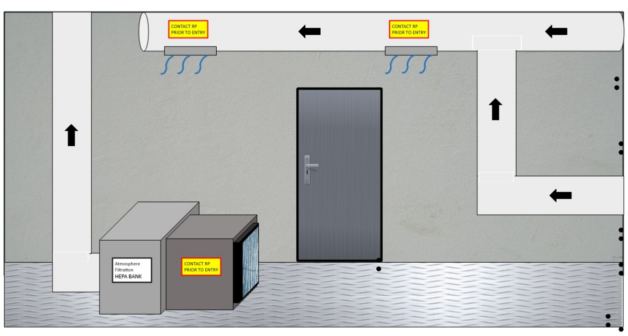
Airflow Patterns

Airflow patterns are conducted to get an idea of how air moves in that specific room or facility. The tests can be done with items such as a smoke stick or fog machine. Typically, airflow studies are done to establish a facility baseline on where air samplers should be stationed for long-term monitoring or job-specific evolutions. An RCT will not usually conduct these tests, but should understand that they exist and why they are conducted.

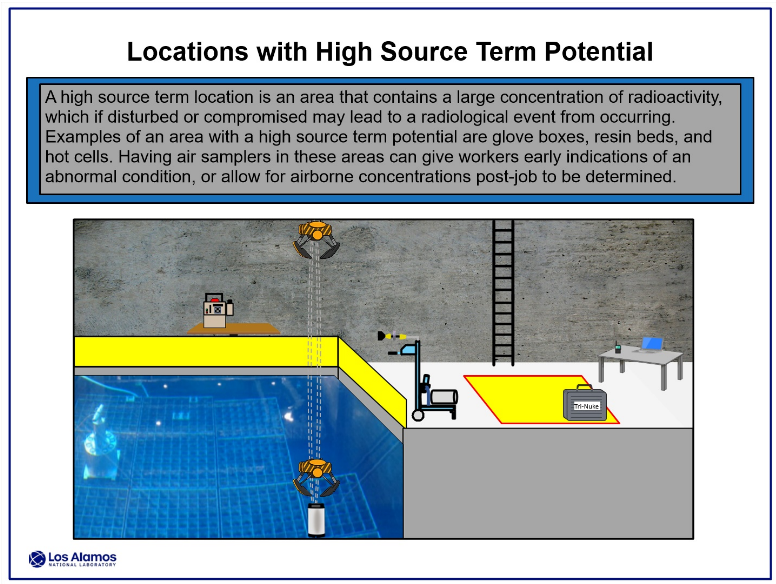
2.16 Facility Features

Facility Features

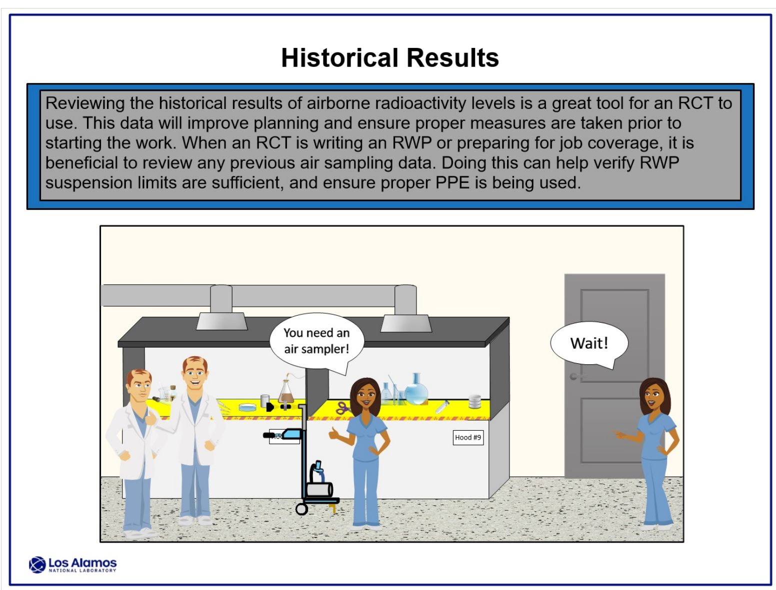
Facility features can provide an RCT guidance on where to place an air sampler by reviewing items such as air exhausts, supplies, and fans. Examining a room for these types of features can help an RCT understand the characteristics of where the air will travel, and better prepare them on where to place the air sampler. An RCT should also be aware of the possible effects of securing or starting the ventilation in the area as well.



2.17 High Source Term

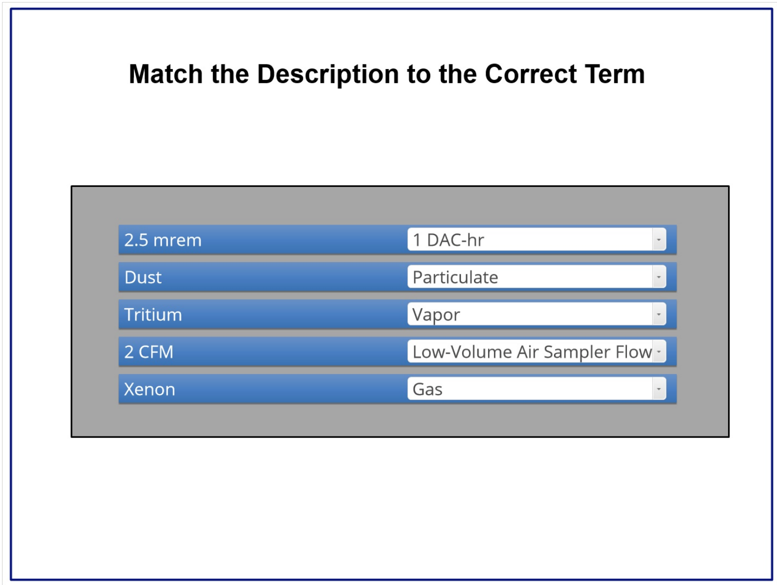


2.18 Historical Results



2.19 Match the Description to the Correct Term

(Matching Drop-down, 10 points, unlimited attempts permitted)

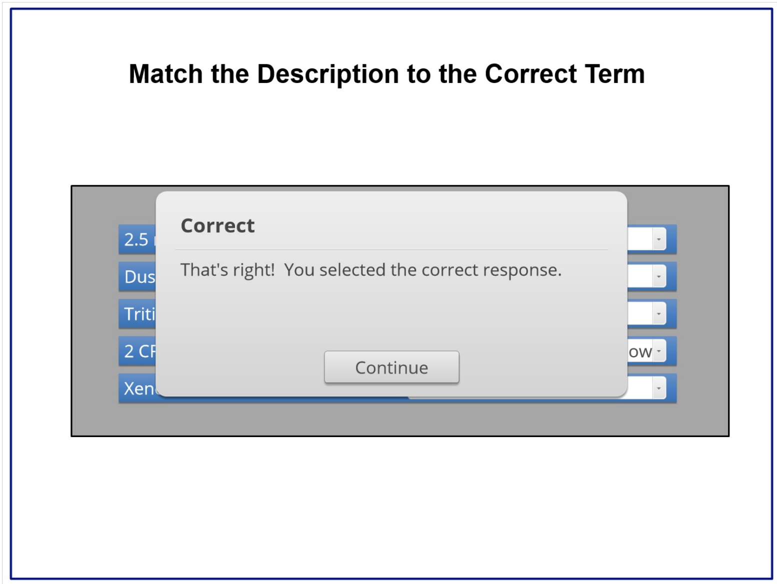


Correct	Choice
2.5 mrem	1 DAC-hr
Dust	Particulate
Tritium	Vapor
2 CFM	Low-Volume Air Sampler Flow
Xenon	Gas

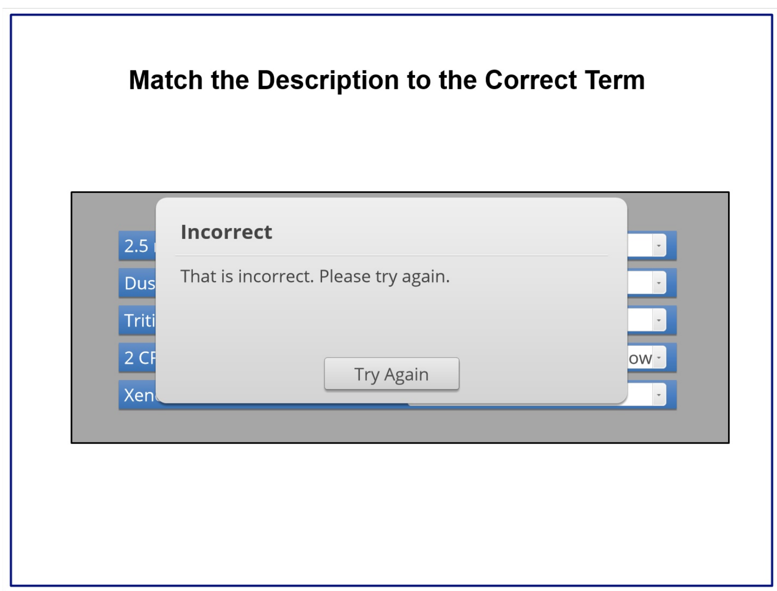
Feedback when correct:

That's right! You selected the correct response.

Correct (Slide Layer)



Try Again (Slide Layer)

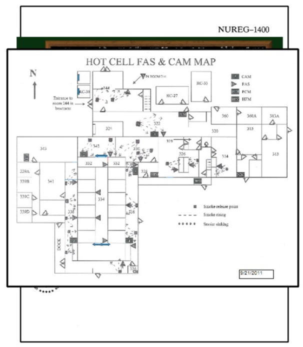


2.20 Air Monitor Placement

Air Monitor Placement Determination

RP-PROG-TP-200, 624.3

4. Refer to NUREG-1400, *Air Sampling in the Workplace* for additional guidance in selecting placement of air sampling equipment.
5. If an airflow study is performed, then document the results using a map.
6. Air sampler inlets must be placed strategically (between workers and point of release, in appropriate air flow locations, in an area representative of breathed air).
7. If strategic placement of air samplers cannot be achieved, then breathing-zone monitoring must be performed.



2.21 Starting an Air Sample

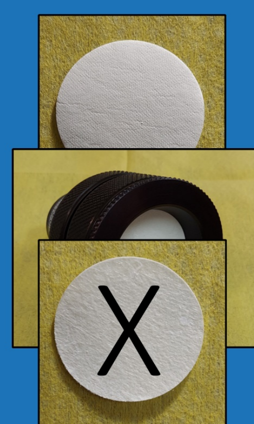
Starting an Air Sample

Perform the following steps when preparing to conduct an air sample:

1. Obtain a new, clean air filter and mark the non-collection side with an “X”. The collection side, as seen in the picture, has a surface that can be easily scraped off. While the non-collection side has a fibrous appearance and is difficult to remove.

<u>**Do not use a marker that bleeds through the filter**</u>

2. Remove the air sampler retaining ring from the sampler head and insert the new filter, ensuring any previous sampling material is removed. Remember to make sure the “X” is on the backside of the filter when placing it on the head.
3. Inspect the gasket/ring for damage or deterioration. Replace the air sampler retaining ring.



Non-collection side

2.22 Starting an Air Sample

Starting an Air Sample

4. Start the pump.
5. Note the time started and indicated flow rate on the sampler rotameter. Ensure flow is 2 CFM +/- 0.25. Adjust the flow control valve to achieve this flow if needed. If flow cannot be maintained in this range, secure the pump, and tag out of service until a flow rate verification can be performed.
6. Record the air sample start date, time, and initial flow rate. This can be done on the air sample filter envelope, a logbook, or another facility specific recording process. HPAL requires these values to calculate the activity concentration of the air sample.

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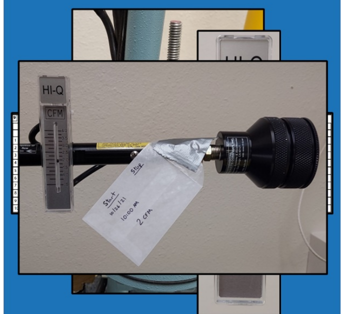
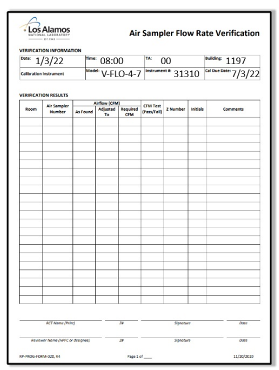


2.23 Flow Rate Verification

Flow Rate Verification

RP-PROG-TP-200, 624.5

1. Flow rates for portable air samplers with rotameters must be verified annually at a minimum, and frequency must be included in facility Routine Monitoring Instructions (RMIs).
2. If starting a new RP-PROG-FORM-020, *Air Sampler Flow Rate Verification*, then record the following:
   - Date and time
   - TA and building
   - Calibration rotameter model
   - Calibration rotameter number
   - Rotameter calibration due date



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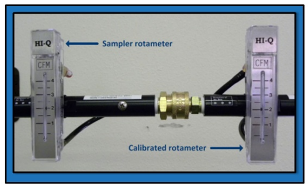
2.24 Flow Rate Verification

Flow Rate Verification

3. For each air sampler, record the following in a new row:
   - Room
   - Air sampler number
   - Required CFM (i.e. 2 CFM)
4. Verify the calibrated rotameter is within calibration.
5. Place a clean filter that is identical to the filter type used for air monitoring in the rotameter.
6. Remove the filter holder from the air sampler.
7. Ensure the air sampler rotameter is oriented within 15 degrees of the vertical position.



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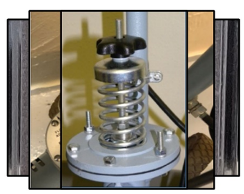
2.25 Flow Rate Verification

Flow Rate Verification

8. Start the air sampler pump

CAUTION
Take rotameter readings at the middle of the floating ball

9. Record the calibrated rotameter CFM reading in the "As Found" column on RP-PROG-FORM-020.
10. The air sampler may either have a regulated air pump or flow control valve. Reference the associated section of RP-PROG-TP-200 to adjust the flow between 1.75 - 2.25 CFM.



11. If the air sampler rotameter does not read between this range, then remove the rotameter from service and inform the HPFC.
12. If the air sampler passed, then complete an air flow verification label and attach to the air samplers rotameter.

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2.26 Collecting an Air Sample

Collecting an Air Sample

When collecting an air sample, there are a few steps that need to be performed to ensure accurate results will be obtained.

1. Note the reading on the rotameter prior to securing the pump. These pumps, although designed for long-term continuous use, have a potential for the flow rate to drift up or down. Even a small fluctuation of 2.0 CFM to 1.8 CFM over a long period time can create a large difference in the total volume collected. Remember, HPAL needs the initial and final flow rates for the air sample activity concentration determinations.
2. Secure the pump and record the stop time, date and flow rate.

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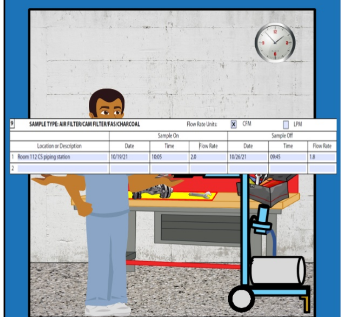

2.27 Collecting an Air Sample

Collecting an Air Sample

3. Remove the air sampler retaining ring.
4. Remove the air filter from the sampler head using clean gloves or tweezers.
5. Place the filter in an envelope or tray.
6. Inspect the gasket/ring for damage or deterioration.
7. Place a new filter on the sampler head if a new sample needs to be started.
8. Replace the air sampler retaining ring.

WARNING

Gloves must be worn when handling air samples

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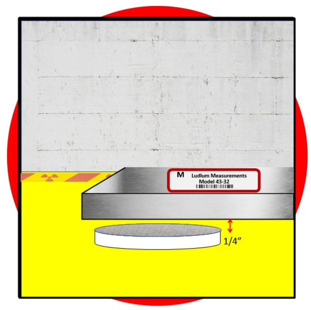
2.28 Field Screening

Field Screening

A field screen of the air sample filter should be conducted to verify conditions of the area are as expected and to ensure HPAL limits are not exceeded. When performing a field screen, the following are best practices to prevent the spread of contamination and get an accurate reading.

- Do not perform while the filter is still in the sampler head. This does not allow the probe to get within 1/4” of the filter, contamination (loose and fixed) from the sampler head can give false readings, and background radiation levels in the area may not allow for a direct reading.
- Remove the air filter from the envelope in an area of low background, place the filter on a clean and flat surface. Frisk hands and change gloves when necessary.
- Using an appropriate contamination instrument, perform a frisk of the air filter at a distance of 1/4”. Wait for counts to stabilize to obtain your reading.



2.29 Value of Concern

Field Screen Value of Concern

RP-PROG-TP-200, 624.4

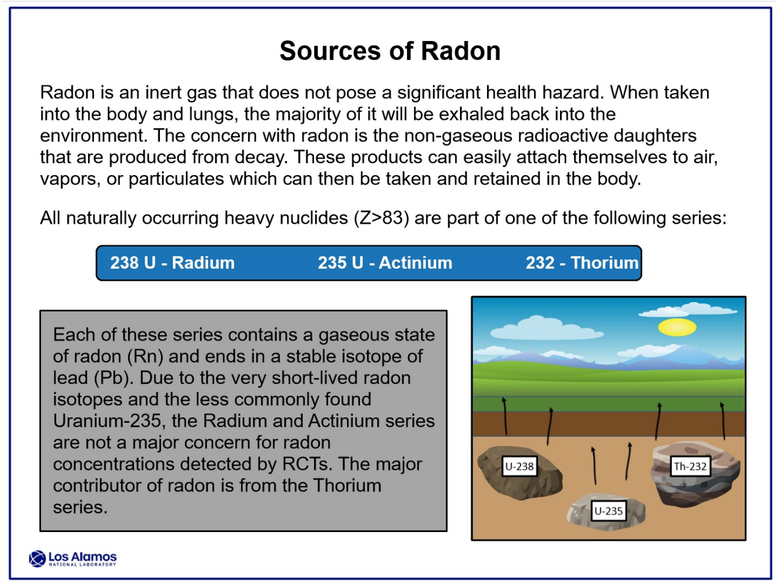
9. If the field screen count rate is >4,000 dpm (combined alpha and beta), then recount the air filter after 30 minutes.
10. If the air filter count is <4,000 dpm after waiting 30 minutes, then submit the sample to HPAL. If the air filter count rate is still >4,000 dpm after 30 minutes, then notify the HPFC.

What is this 30 minute wait for?

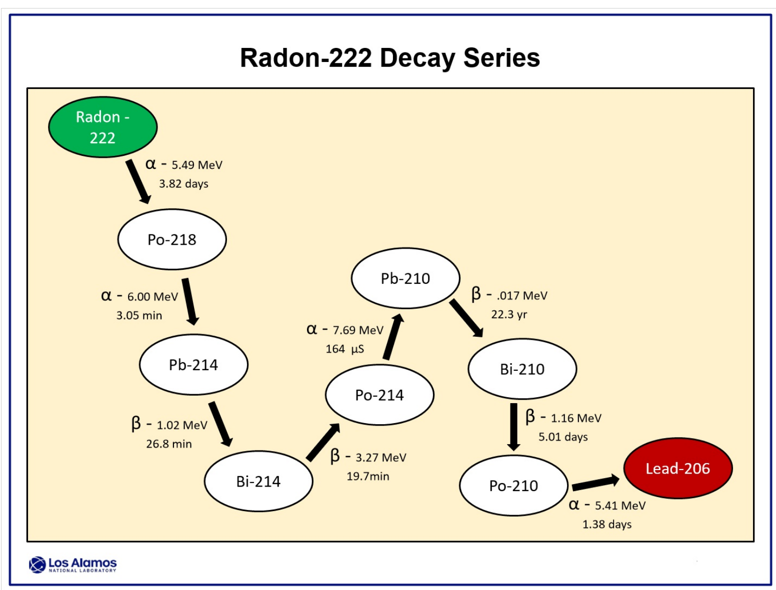
Radon decay: Counts will decrease ~ 50% if the source is radon

As an RCT, you may encounter this short-lived naturally occurring radioisotope on a regular basis. Understanding where it comes from and how it decays can help an RCT better distinguish radon from actual contamination.

2.30 Sources of Radon



2.31 Rn-222 Decay Series



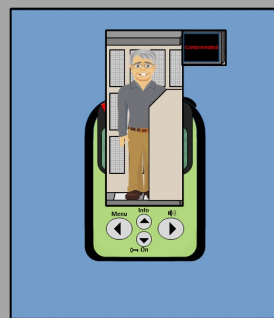
2.32 Radon Characteristics

Radon Characteristics

The best way to determine whether the source of contamination is a result of radon is to wait and allow it to decay. However, radon does have certain characteristics that an RCT can use to decide if radon is the likely cause for elevated counts.

- Frequent PCM alarms on snowy days
- The detected contamination on an individual moves from location to location
- Both alpha and beta contamination are found

As an RCT, some of these radon traits will become more apparent over time. But it is important to never assume contamination found is from radon. Always follow facility specific guidance and consult with an HPFC if radon is suspected.

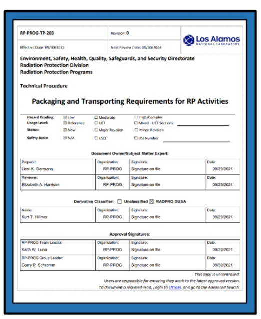


2.33 Submitting Air Samples to HPAL

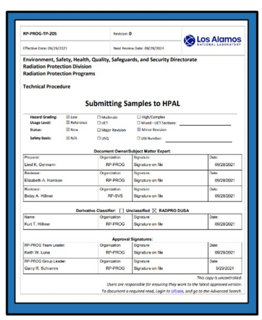
Submitting Air Samples to HPAL

After you have performed your field screen counts of the air filters it is time to submit your samples to HPAL for further analysis.

To properly document and transport the air samples, RP-PROG-TP-203 *Packaging and Transporting Requirements for RP Activities* and RP-PROG-TP-205 *Submitting Samples to HPAL* will need to be used. This process is discussed in the HPAL section of this training.



Packaging and Transporting Requirements for RP Activities



Submitting Samples to HPAL

2.34 HPAL Results

HPAL Results

After receiving the HPAL Analysis Report it is time to review the results.

HPAL ANALYSIS REPORT
FILE: 29268057

Sample Description	Analysis Information	Contact Information
Login Date: 10/27/21	Instrument: Bert1 2010-AMS	Name: MCTECH BILL
Sample Type: Air Sample	Analysis: GrossAB	Phone: 867-5309
Location TA:3 Bldg: 0066	Date: 10/29/21	Email: MCTECHB@LANL.GOV
Room: B100	Analyst: NEAL KELSEY N	
Priority: Routine		

Analyst Comments:
Results not adjusted for energy, attenuation, or yield unless noted.

Submitter Comments:
None

Sample ID	Alpha Activity	2* sigma	Alpha MDA	Beta Activity	2* sigma	Beta MDA	Run Time	Flow Rate
	(dpm/m3)	(dpm/m3)	(dpm/m3	(dpm/m3)	(dpm/m3)	(dpm/m3)	(h)	(cfm)
1	NDA	NDA	2.11	83.74	13.586	3.5	0.85	2.0

The alpha activity for the air sample is NDA and the beta is 83.74. Notice that the units for this readout are in dpm/m3. To translate this activity into a DAC fraction we will need to convert these to µCi/mL and then divide that value by the associated radionuclide DAC value.

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2.35 Sample Unit Conversion

Sample Unit Conversion

To convert the alpha or beta activity units to µCi/mL, you will use the conversion equations shown here.

Now that the activity is in the correct units, it is time to compare them to the DAC value.

HPAL ANALYSIS REPORT
FILE: 29268057

Sample Description	Analysis Information	Contact Information
Login Date: 10/27/21	Instrument: Bert1 2010-AMS	Name: MCTECH BILL
Sample Type: Air Sample	Analysis: GrossAB	Phone: 867-5309
Location TA:3 Bldg: 0066	Date: 10/29/21	Email: MCTECHB@LANL.GOV
Room: B100	Analyst: NEAL KELSEY N	
Priority: Routine		

Analyst Comments:
Results not adjusted for energy, attenuation, or yield unless noted.

Submitter Comments:
None

Sample ID	Alpha Activity	2* sigma	Alpha MDA	Beta Activity	2* sigma	Beta MDA	Run Time	Flow Rate
	(dpm/m3)	(dpm/m3)	(dpm/m3	(dpm/m3)	(dpm/m3)	(dpm/m3)	(h)	(cfm)
1	NDA	NDA	2.11	83.74	13.586	3.5	0.85	2.0

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$$\text{dpm/m3} \Rightarrow \mu\text{Ci/mL}$$

$$\frac{\text{(x) dpm}}{\text{m3}} \times \frac{1\mu\text{Ci}}{2.22\text{E6 dpm}} \times \frac{\text{m3}}{10^{6}\,\text{ml}}$$

$$\frac{83.7\ \cancel{\text{dpm}}}{\cancel{\text{m3}}} \times \frac{1\mu\text{Ci}}{2.22\text{E6}\ \cancel{\text{dpm}}} \times \frac{\cancel{\text{m3}}}{10^{6}\,\text{ml}}$$

$$\frac{83.7\ \mu\text{Ci}}{2.22\text{E12 mL}}$$

$$= 3.77 \times 10^{-11}\ \mu\text{Ci/mL}$$

2.36 DAC Fraction Conversion

DAC Fraction Conversion

A DAC Fraction is obtained from dividing the activity previously calculated by a DAC value. If the radioisotope(s) from the air sample is known, then this number can be found directly in 10CFR835, *Occupational Radiation Protection*, Appendix A, as shown below.

Department of Energy — **Pt. 835, App. A**

Radionuclide	Absorption type[3] µCi/mL			Absorption type[3] Bq/m[3]			Stochastic or organ or tissue[1]
	F	M	S	F	M	S	(F/M/S)
Pu-235	–	9 E – 05	8 E – 05	–	3 E + 06	3 E + 06	/ET/ET
Pu-236	–	1 E – 11	7 E – 11	–	6 E – 01	2 E + 00	/BS/St
Pu-237	–	1 E – 06	1 E – 06	–	7 E + 04	6 E + 04	/St/St
Pu-238	–	6 E – 12	5 E – 11	–	2 E – 01	1 E + 00	/BS/St
Pu-239	–	5 E – 12	6 E – 11	–	2 E – 01	2 E + 00	/BS/BS
Pu-240	–	5 E – 12	6 E – 11	–	2 E – 01	2 E + 00	/BS/BS
Pu-241	–	2 E – 10	2 E – 09	–	1 E + 01	1 E + 02	/BS/BS
Pu-242	–	5 E – 12	6 E – 11	–	2 E – 01	2 E + 00	/BS/BS
Pu-243	–	5 E – 06	5 E – 06	–	1 E + 05	1 E + 05	/E/E
Pu-244	–	5 E – 12	6 E – 11	–	2 E – 01	2 E + 00	/BS/BS
Pu-245	–	9 E – 07	8 E – 07	–	3 E + 04	3 E + 04	/St/St
Pu-246	–	8 E – 08	8 E – 08	–	3 E + 03	2 E + 03	/St/St
Am-237	–	8 E – 06	–	–	3 E + 05	–	/ET/
Am-238	–	2 E – 06	–	–	9 E + 04	–	/BS/
Am-239	–	1 E – 06	–	–	6 E + 04	–	/ET/
Am-240	–	7 E – 07	–	–	2 E + 04	–	/ET/
Am-241	–	5 E – 12	–	–	1 E – 01	–	/BS/

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DAC for Unknown Radioisotopes	
Beta emission	4 E-11 DAC µCi/mL
Alpha emission	2 E-13 DAC µCi/mL

$$\text{DAC-fraction} = \frac{\text{sample activity } (\mu\text{Ci/mL})}{\text{DAC value } (\mu\text{Ci/mL})}$$

$$\frac{3.77\text{ E-11 }\mu\text{Ci/mL}}{4\text{ E-11 }\mu\text{Ci/mL}}$$

DAC-fraction = 0.94

2.37 Multiple DAC Fractions

Multiple DAC Fractions

There may be times when an air sample will have detected activity for both alpha and beta. To determine the DAC fraction when this occurs the same process as the previous example will need to be performed, and then the DAC fractions will be added together to get a total sum of DAC.

Sample ID	Alpha Activity	2* sigma	Alpha MDA	Beta Activity	2* sigma	Beta MDA	Run Time	Flow Rate
	(dpm/m3)	(dpm/m3)	(dpm/m3	(dpm/m3)	(dpm/m3)	(dpm/m3)	(h)	(cfm)
1	8.09	7.504	6.7	124.75	13.586	11.71	0.25	2.0

Unknown Alpha

$$\frac{8.09\text{ dpm}}{\text{m3}} \times \frac{1\mu\text{Ci}}{2.22\text{ E6 dpm}} \times \frac{\text{m3}}{10^6\text{ mL}}$$

$$\frac{8.09\ \mu\text{Ci}}{2.22\text{ E12 mL}} = 3.64\text{ E-12 }\mu\text{Ci/mL}$$

$$\frac{3.64\text{ E-12 }\mu\text{Ci/mL}}{2\text{ E-13 }\mu\text{Ci/mL}} = \boxed{18.2}$$

Unknown Beta

$$\frac{124.75\text{ dpm}}{\text{m3}} \times \frac{1\mu\text{Ci}}{2.22\text{ E6 dpm}} \times \frac{\text{m3}}{10^6\text{ mL}}$$

$$\frac{124.75\ \mu\text{Ci}}{2.22\text{ E12 mL}} = 5.62\text{ E-11 }\mu\text{Ci/mL}$$

$$\frac{5.62\text{ E-11 }\mu\text{Ci/mL}}{4\text{ E-11 }\mu\text{Ci/mL}} = \boxed{1.4}$$

Sum of DAC

$= \text{DAC}(\alpha) + \text{DAC}(\beta)$

$= 18.2 + 1.4$

$\boxed{= 19.6}$

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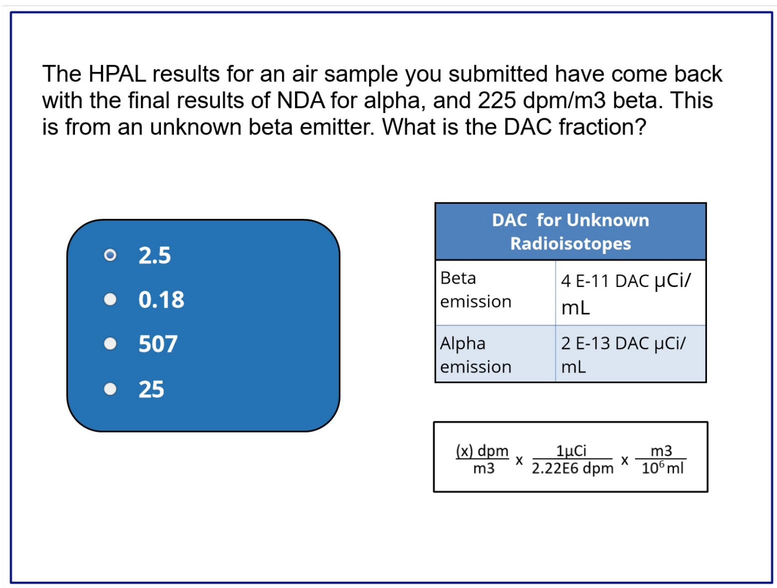
2.38 The HPAL results for an air sample you submitted have come back with the final results of NDA for alpha, and 225 dpm/m3 beta. This is from an unknown beta emitter. What is the DAC fraction?

(Multiple Choice, 10 points, unlimited attempts permitted)

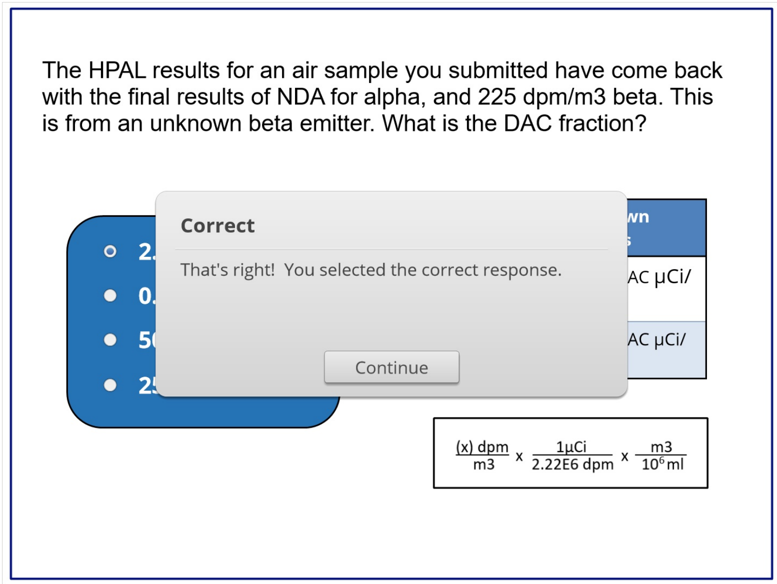


Correct	Choice
X	2.5
	0.18
	507
	25

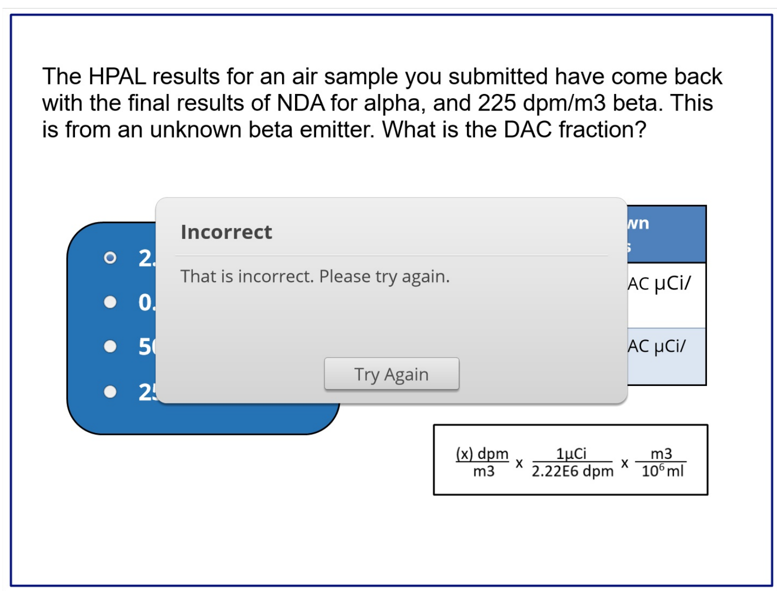
Feedback when correct:

That's right! You selected the correct response.

Correct (Slide Layer)



Try Again (Slide Layer)



2.39 Airborne Postings

Airborne Postings

Knowing the DAC levels in an area is necessary to ensure proper measures are in place and the correct actions are taken if limits are exceeded. This may include the need to stop work due to an RWP suspension limit being exceeded, upgrading respiratory equipment with a higher protection factor, or posting a room as an Airborne Radioactivity Area (ARA).

Airborne Radioactivity Area	
Area Type	Air Concentration
Any accessible area where the concentration of airborne radioactivity, above natural background, exceeds or is likely to exceed the DAC values listed in Appendix A or Appendix C of 10 CFR 835	1 DAC
An area where an individual without respiratory protection could receive an intake exceeding 12 DAC-hr in a week	0.3 DAC (12 DAC-hr/40 hr)

As mentioned in the beginning of this lesson, airborne monitoring is a critical aspect in a Radiation Protection Program. RCTs need to know their procedural requirements when performing radiological air monitoring and have an understanding of the theory behind what they are doing.

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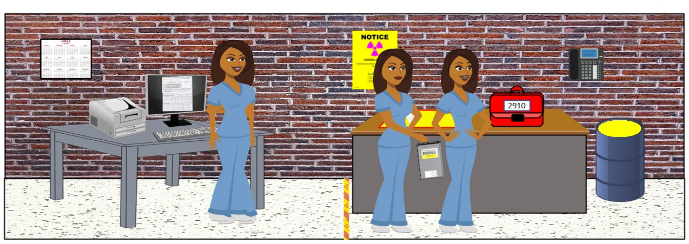
3. Submitting Samples to HPAL

3.1 Health Physics Analysis Laboratories

Health Physics Analysis Laboratories

The Health Physics Analysis Laboratories (HPAL) conducts radioanalytical services and bioassay monitoring. Non-destructive radioactive sample analyses are performed in support of LANL Radiation Protection and Environmental Stewardship programs. Some of the analytical capabilities include gross alpha/beta counting, liquid scintillation analysis, and isotopic analysis. RCT's are responsible for complying with the procedures of documenting, packaging, and submitting radiological samples to HPAL.



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3.2 HPAL Location

HPAL Location

HPAL is located in TA-3, Building 2010

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3.3 Accessing HPAL

Accessing HPAL

The HPAL webpage can be found on the Radiation Protection LANL Inside homepage. Here you can view the HPAL contact information, descriptions of the analytical capabilities, access to sample results, and a link for the HPAL Sample Submittal Form, RP-SVS-HPAL-001.

In this training, we will go over the requirements on how to prepare the samples, filling out the submittal form, what to do when arriving at HPAL, and how to track and log out your samples after they have been analyzed. To view HPAL results, the Radiation Protection Application Catalog can be used to access the HPAL data retrieval page.

Click the link to access the HPAL page

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3.4 HPAL Sample Types and Analysis

HPAL Sample Types and Analysis

	NuCon	Air Filter	Activity Report	LSC/H-3 Smear	Liquid	Oil	Nasal Smear	H-3 Air Filter	Charcoal Filter	Other
Gross α/β	✓	✓	✓							Contact
Liquid Scint.				✓	✓	✓	✓	✓		Contact
Isotopic	✓	✓	Contact	Contact	✓	✓	Contact		✓	✓
Leak Test	✓			✓						✓
Source Std.										✓

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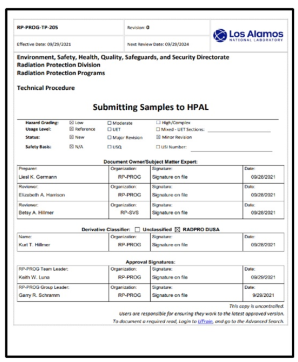
3.5 HPAL Procedure

HPAL Procedure

RP-PROG-TP-205, ***Submitting Samples to HPAL***

This procedure provides the precautions and limitations of submitting samples to HPAL, guidance on sample preparation, batch preparation, and step-by-step instructions on how to fill out the HPAL Sample Submittal Form.

The different sample types covered in RP-PROG-TP-205 includes smears, air filters, liquid scintillation samples, charcoal filters, nasal smears, tape presses, and personal protective equipment samples.



RP-PROG-TP-205	Revision: 0	Los Alamos NATIONAL LABORATORY
Effective Date: 09/29/2021	Next Review Date: 09/29/2024	

Environment, Safety, Health, Quality, Safeguards, and Security Directorate
Radiation Protection Division
Radiation Protection Programs

Technical Procedure

Submitting Samples to HPAL

Hazard Grading: ☒ Low ☐ Moderate ☐ High/Complex
Usage Level: ☒ Reference ☐ UET ☐ Mixed - UET Sections: ______
Status: ☒ New ☐ Major Revision ☒ Minor Revision
Safety Basis: ☒ N/A ☐ USQ ☐ USI Number: ______

Document Owner/Subject Matter Expert:

Preparer: Liesl K. Germann	Organization: RP-PROG	Signature: Signature on file	Date: 09/28/2021
Reviewer: Elizabeth A. Harrison	Organization: RP-PROG	Signature: Signature on file	Date: 09/28/2021
Reviewer: Betsy A. Hillmer	Organization: RP-SVS	Signature: Signature on file	Date: 09/28/2021

Derivative Classifier: ☐ Unclassified ☒ RADPRO DUSA

Name: Kurt T. Hillmer	Organization: RP-PROG	Signature: Signature on file	Date: 09/28/2021

Approval Signatures:

RP-PROG Team Leader: Keith W. Luna	Organization: RP-PROG	Signature: Signature on file	Date: 09/29/2021
RP-PROG Group Leader: Garry R. Schramm	Organization: RP-PROG	Signature: Signature on file	Date: 9/29/2021

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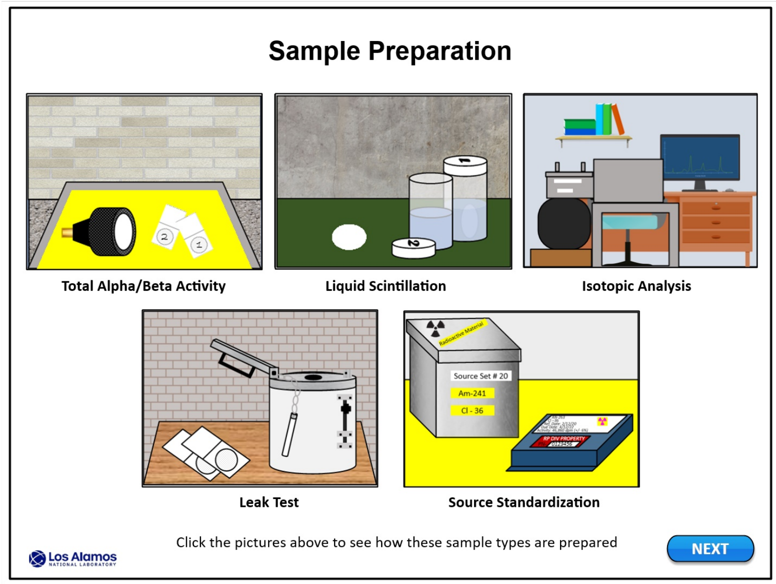
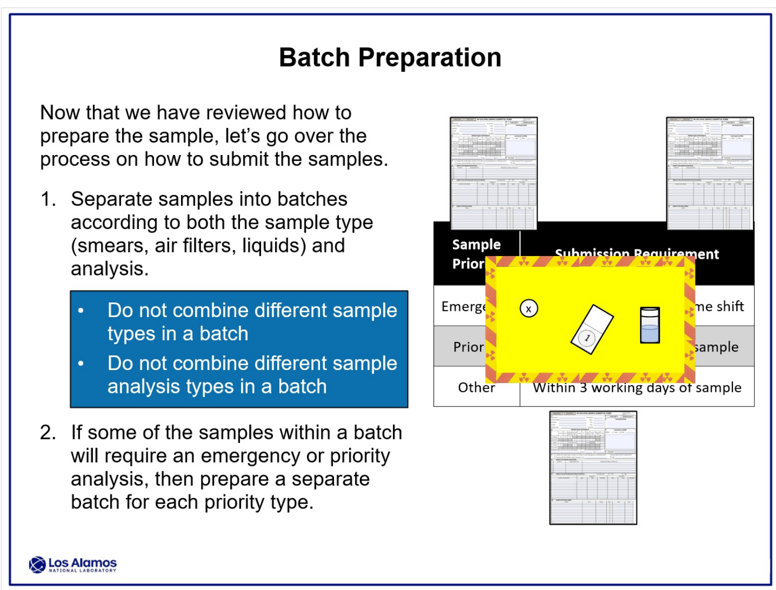
3.6 Sample Preparation



3.7 Batch Preparation



3.8 Batch Preparation

RP-PROG-TP-203	Revision: 0	Los Alamos NATIONAL LABORATORY
Effective Date: 09/30/2021	Next Review Date: 09/30/2024	

Environment, Safety, Health, Quality, Safeguards, and Security Directorate
Radiation Protection Division
Radiation Protection Programs

Batch Type	Maximum Number of Samples
Gross Alpha/Beta Analysis	100
LSC Analysis	50
Isotopic Analysis	10

RP-PROG Team Leader: Keith W. Luna	Organization: RP-PROG	Signature: Signature on file	Date: 09/29/2021
RP-PROG Group Leader: Garry R. Schramm	Organization: RP-PROG	Signature: Signature on file	Date: 09/30/2021

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To document a required read, Login to UTrain, and go to the Advanced Search.

Batch Preparation

3. Ensure the number of samples within a batch does not exceed the HPAL maximum.
4. Package each batch separately for transport per instructions in RP-PROG-TP-203, *Packaging and Transporting Requirements for RP Activities*.
5. Place a sample tracking barcode on the primary container of the batch (plastic bag).

NOTE 1: *When submitting disk smears, ensure each one is numbered and they are stapled together in groups of 10 (if applicable).*

Notes:

3.9 Select the Correct Drop-Down Option

(Matching Drop-down, 10 points, unlimited attempts permitted)

Select the Correct Drop-Down Option

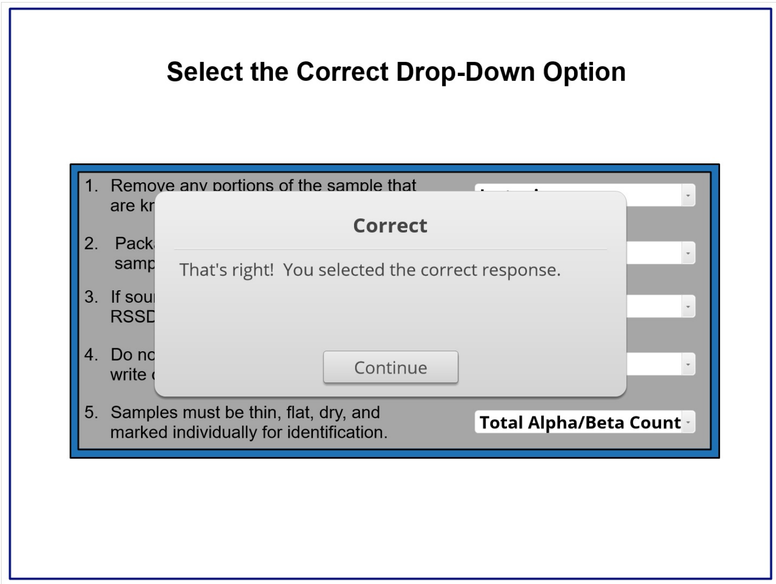
1. Remove any portions of the sample that are known not to have activity present.	Isotopic
2. Package/transport source standardization samples in accordance of RP-PROG-TP-203.	Source Standard
3. If source is accountable, place the RSSDMS ID number on submittal form.	Leak Test
4. Do not mark on smear/filter. Only write on cap.	LSC
5. Samples must be thin, flat, dry, and marked individually for identification.	Total Alpha/Beta Count

Correct	Choice
Remove any portions of the sample that are known not to have activity present.	Isotopic
Package/transport source standardization samples in accordance of RP-PROG-TP-203.	Source Standard
If source is accountable, place the RSSDMS ID number on submittal form.	Leak Test
Do not mark on smear/filter. Only write on cap.	LSC
Samples must be thin, flat, dry, and marked individually for identification.	Total Alpha/Beta Count

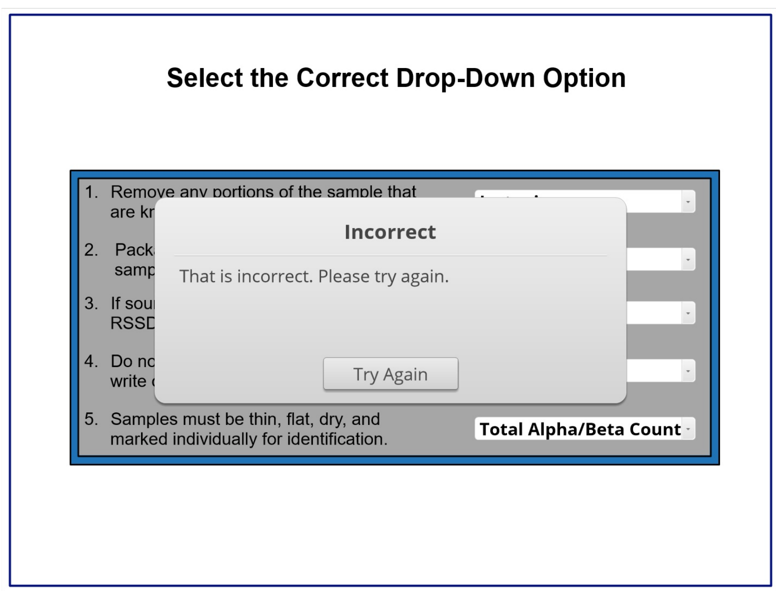
Feedback when correct:

That's right! You selected the correct response.

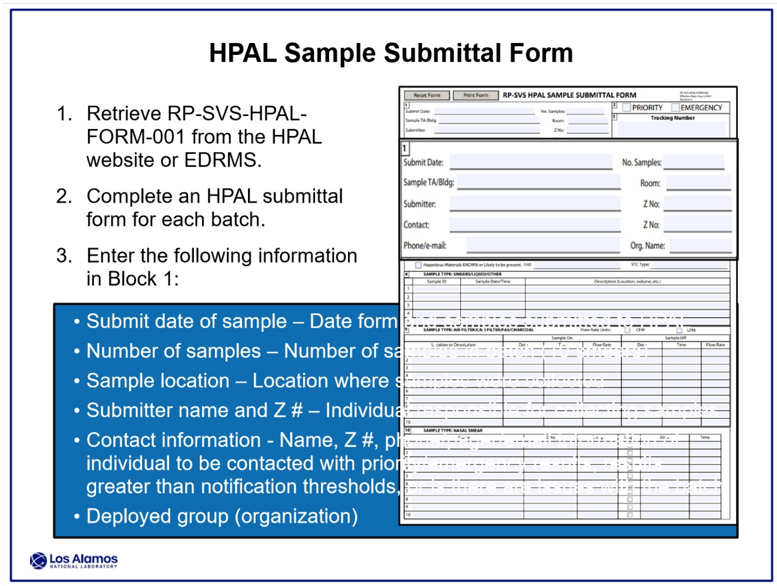
Correct (Slide Layer)



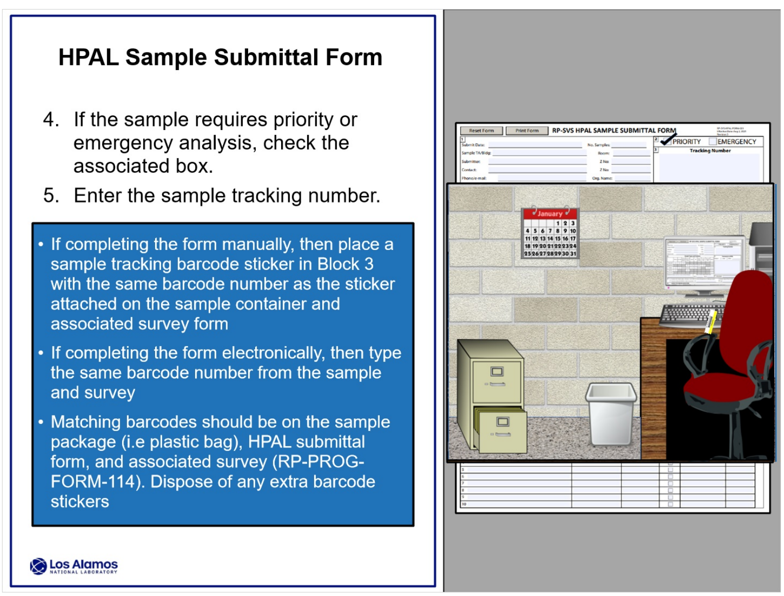
Try Again (Slide Layer)



3.10 HPAL Sample Submittal Form



3.11 HPAL Sample Submittal Form



3.12 HPAL Sample Submittal Form

HPAL Sample Submittal Form

6. Select the sample type(s) and desired analyses in Block 4.
   - If multiple analyses are required for a sample type, then check all boxes that apply and add comments in Block 5.
7. If submitting samples for isotopic analysis, leak tests or source standardizations, then compete the nuclide information in Block 4.
   a) Enter any known or suspected nuclides, or enter “See Below” and list the nuclides in Block 8, or enter “see attached” and list nuclides on an attached survey form.
   b) Enter the total batch alpha and beta field screen results, or the highest individual sample alpha and beta field screen results, whichever is higher.

NOTE 1: *Alpha and beta field screen results are required for isotopic analyses, and for known or suspect samples/batches exceeding the HPAL notification limits.*

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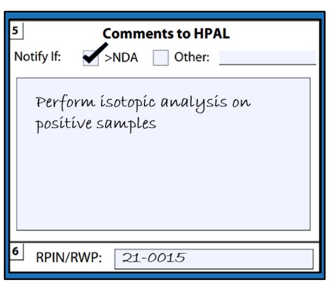
3.13 HPAL Sample Submittal Form

HPAL Sample Submittal Form



8. If a prompt notification by HPAL of elevated results is required, then select the “> NDA” checkbox for notification of any positive results, or select the “Other” checkbox and enter a specific value for the contact “Notification Limit” in BLOCK 5.
9. Enter any additional analyses, comments or directions to HPAL in BLOCK 5. Examples include, “Return samples to submitter”, or “Perform isotopic analysis on positive samples”.
10. If samples are part of an RPIN, RWP, or work control document, then enter applicable information in BLOCK 6.

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3.14 Notification Limits

HPAL Notification Limits

HPAL needs to be contacted prior to submitting any samples exceeding their notification limits. The use of field checks and historical data can help prevent these limits from being violated.

Type	Limit
Alpha Contamination	≥ 5k dpm
Beta Contamination	≥ 10k dpm
β/γ Radiation	≥ 0.5 mR/hr on contact
Tritium Contamination	≥ 400k dpm

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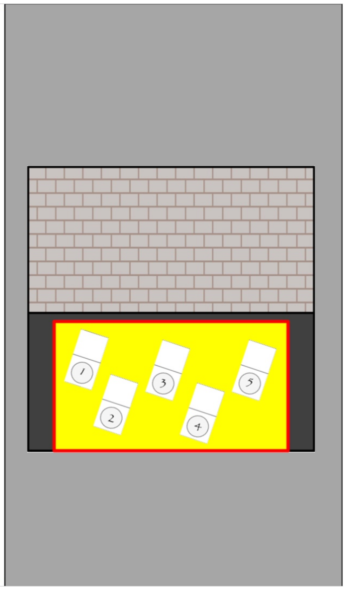


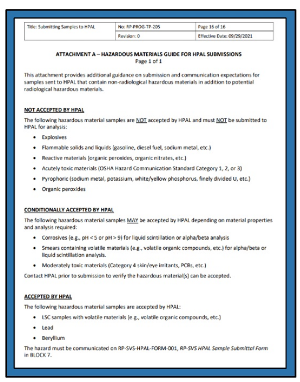
3.15 Hazardous Materials

Hazardous Materials

When submitting samples to HPAL, non-radiological hazards need to be considered as well. RP-PROG-TP-205, Attachment A – *Hazardous Materials Guide for HPAL Submissions,* lists the different types of materials accepted and not accepted by HPAL.

It is important to reference this procedure or to contact HPAL when unsure about whether a certain material may be sent for analysis.

If an approved hazardous material is going to be submitted, annotate this on the sample submittal form by selecting the box in Block 7 and list all known hazardous materials.



Title: Submitting Samples to HPAL	No: RP-PROG-TP-205	Page 16 of 16
	Revision: 0	Effective Date: 09/29/2021

ATTACHMENT A – HAZARDOUS MATERIALS GUIDE FOR HPAL SUBMISSIONS
Page 1 of 1

This attachment provides additional guidance on submission and communication expectations for samples sent to HPAL that contain non-radiological hazardous materials in addition to potential radiological hazardous materials.

NOT ACCEPTED BY HPAL

The following hazardous material samples are NOT accepted by HPAL and must NOT be submitted to HPAL for analysis:

- Explosives
- Flammable solids and liquids (gasoline, diesel fuel, sodium metal, etc.)
- Reactive materials (organic peroxides, organic nitrates, etc.)
- Acutely toxic materials (OSHA Hazard Communication Standard Category 1, 2, or 3)
- Pyrophoric (sodium metal, potassium, white/yellow phosphorus, finely divided U, etc.)
- Organic peroxides

CONDITIONALLY ACCEPTED BY HPAL

The following hazardous material samples MAY be accepted by HPAL depending on material properties and analysis required:

- Corrosives (e.g., pH < 5 or pH > 9) for liquid scintillation or alpha/beta analysis
- Smears containing volatile materials (e.g., volatile organic compounds, etc.) for alpha/beta or liquid scintillation analysis.
- Moderately toxic materials (Category 4 skin/eye irritants, PCBs, etc.)

Contact HPAL prior to submission to verify the hazardous material(s) can be accepted.

ACCEPTED BY HPAL

The following hazardous material samples are accepted by HPAL:

- LSC samples with volatile materials (e.g., volatile organic compounds, etc.)
- Lead
- Beryllium

The hazard must be communicated on RP-SVS-HPAL-FORM-001, *RP-SVS HPAL Sample Submittal Form* in BLOCK 7.

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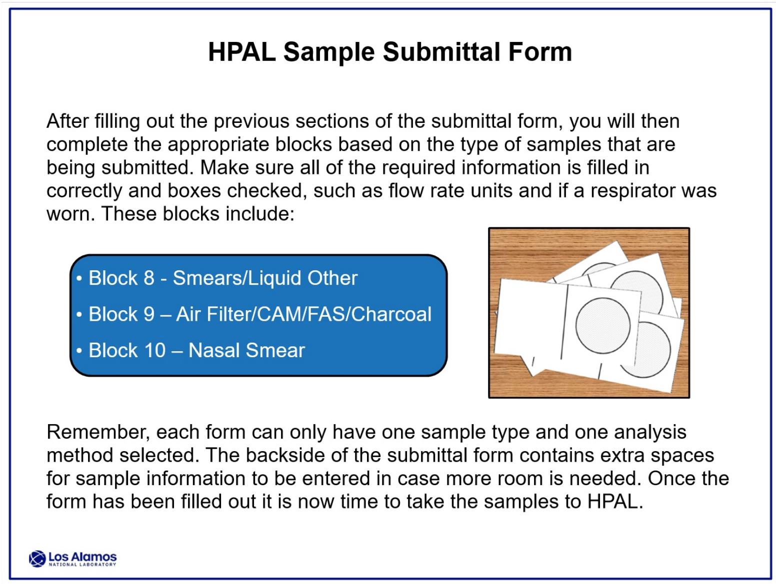
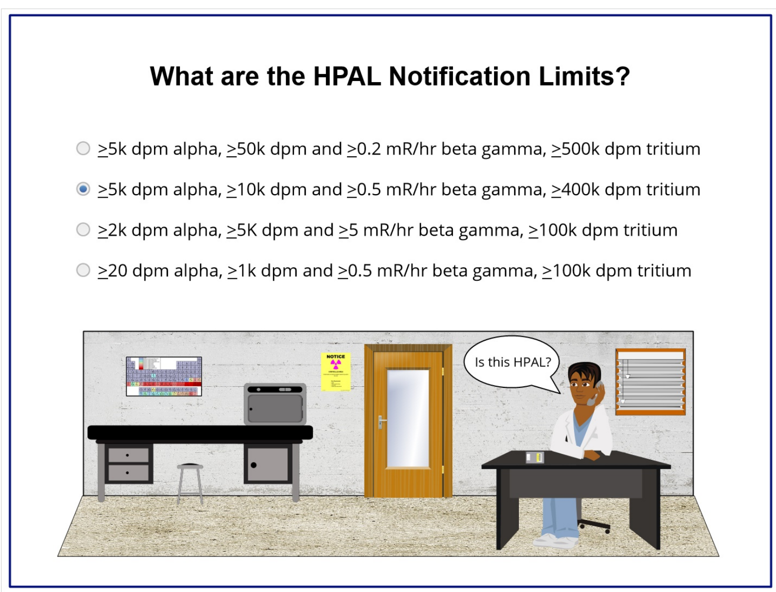
3.16 HPAL Sample Submittal Form



3.17 What are the HPAL Notification Limits?

(Multiple Choice, 10 points, unlimited attempts permitted)



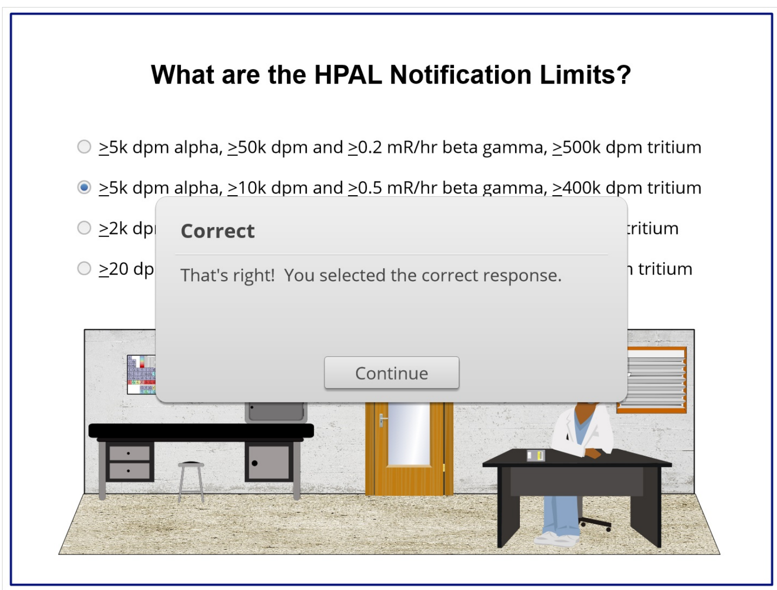
Correct	Choice
	>5k dpm alpha, >50k dpm and >0.2 mR/hr beta gamma, >500k dpm tritium

X	>5k dpm alpha, >10k dpm and >0.5 mR/hr beta gamma, >400k dpm tritium
	>2k dpm alpha, >5K dpm and >5 mR/hr beta gamma, >100k dpm tritium
	>20 dpm alpha, >1k dpm and >0.5 mR/hr beta gamma, >100k dpm tritium

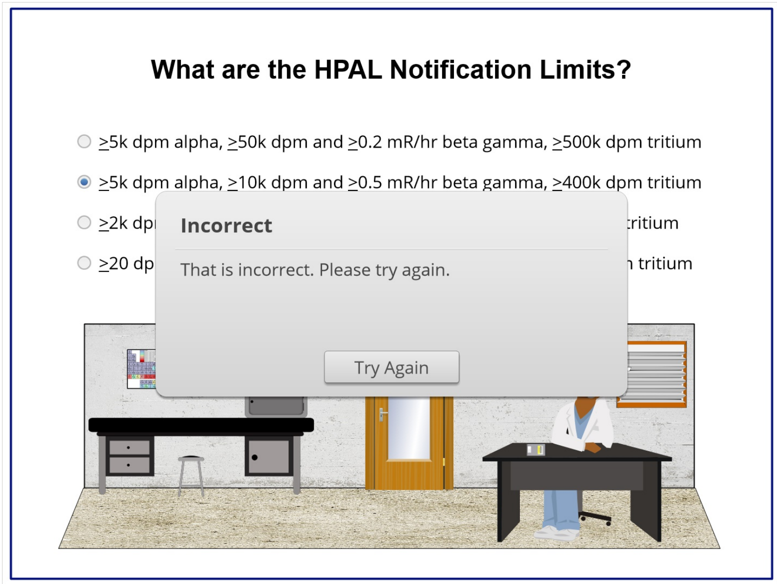
Feedback when correct:

That's right! You selected the correct response.

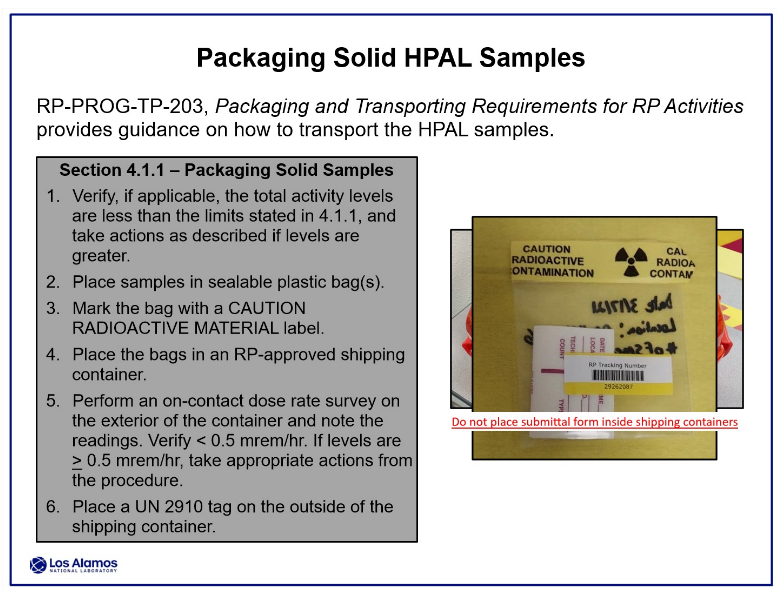
Correct (Slide Layer)



Try Again (Slide Layer)



3.18 Packaging Solid HPAL Samples



3.19 Packaging Non-Tritium Liquid HPAL Samples

Packaging Non-Tritium Liquid HPAL Samples

Section 4.1.2 – Packaging Non-Tritium Liquid Samples

1. Verify, if applicable, the total activity levels are less than the limits stated in 4.1.2, and take actions as descried if levels are greater.
2. Place absorbent material on the bottom of an RP approved shipping container.
3. Place samples in an RP-approved shipping container tray.
4. Mark the tray with a CAUTION RADIOACTIVE MATERIAL label.

CAUTION

Inner packaging containing liquids must be packaged and maintained with their closures upward (49CFR§173.24a(a)(1)).

5. Place tray in the shipping container and perform an on-contact survey on the outside of the container. Verify levels < 0.5 mrem/hr. Take similar actions as with solid samples levels exceeding 0.5 mrem/hr.
6. Mark the outside of the container with a UN2910 label.

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3.20 Packaging Tritium Samples

Packaging Tritium Samples

Section 4.1.3 – Packaging Tritium Samples

CAUTION

- Tritium samples mixed with other radionuclides may NOT be packaged using instructions in this section.
- Inner liquid containers (vials, tubes, bottles, etc.) must NOT be filled more than ¾ to the top to allow for expansion and prevent spilling when opened.

1. Verify, if applicable, the total activity levels are less than the limits stated in 4.1.3, and take actions as descried if levels are greater.
2. Place absorbent material in the bottom of a durable, leak-proof container.
3. Place the samples in the container such that the samples are maintained with closures in an upright position during transport

Do not place submittal form inside shipping containers

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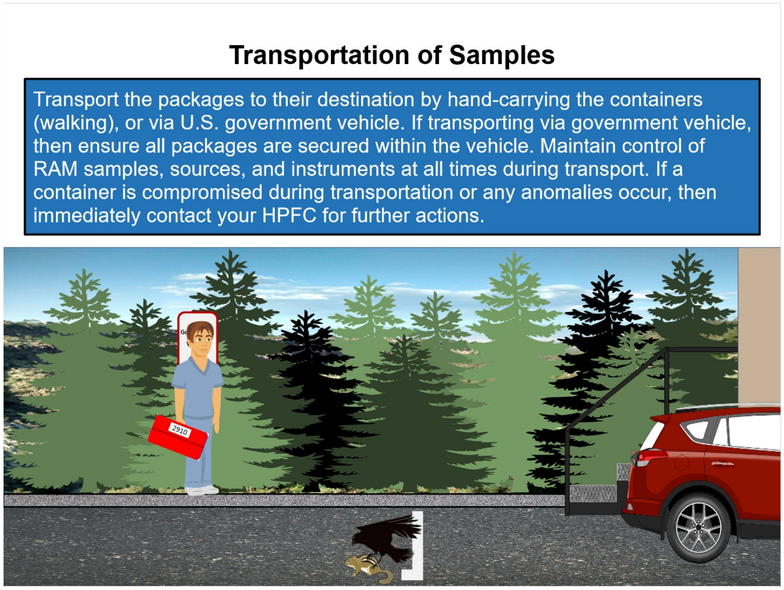
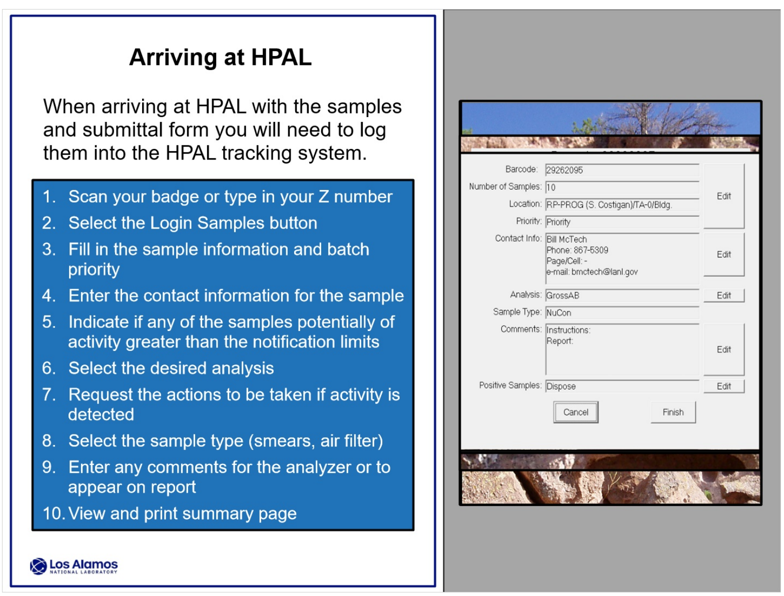
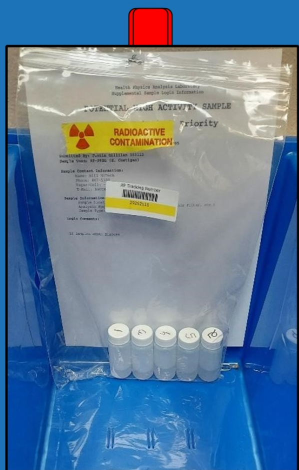
3.21 Transportation of Samples



3.22 Arriving at HPAL



3.23 Sample Drop-Off



Sample Drop-Off

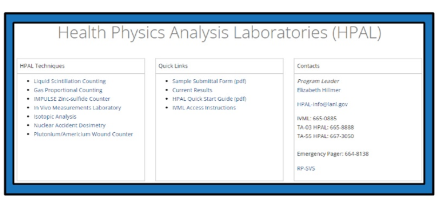
- Verify the information on the forms match and the point of contact can be reached when the analysis is complete
- Attach the Supplemental Sample Login Information sheet to the HPAL Submittal Form and the samples
- To prevent a spread of contamination, ensure the staple is above the sealing portion of the sample bag
- If the sample has a priority/emergency status, make sure that HPAL is aware prior to leaving
- Make sure all the samples are properly labeled and inside of a plastic bag (including liquids) when placing in the appropriate bins

3.24 Picking Up and Logging Out Samples

Picking Up and Logging Out Samples

HPAL will dispose of most low-level smears, air samples, and low-volume liquid waste after the analysis is complete. RCTs are expected to pick up their samples containing levels of higher contamination and larger liquid volumes, and to dispose of them according to their local facility guidelines. It is the responsibility of the RCT to log their sample out of the HPAL sample tracking system once they are collected or disposed of.

Over 200,000 samples are analyzed at HPAL in a given year. In order to create a smooth process, follow the guidance of RP-PROG-TP-203 and RP-PROG-TP-205 while submitting radiological samples, and reach out to the HPAL office whenever there is a question or concern.



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3.25 Total Alpha/Beta Activity Samples

Total Alpha/Beta Activity Samples

1. Mark each sample individually for identification (e.g., number).
   - Do not use a marker that will bleed through the sample
   - Underline sample numbers that can be misread (6 and 9)
2. Ensure sample dimensions are less than 50 mm (2 inches) in diameter, or 50 mm at the greatest dimension (if not round).
3. Ensure all sample material is non-dispersible by removing any excess material that is not adhering to the sample media (dirt, oil, etc.).
4. If a sample is wet, then ensure media is allowed to dry before packaging.
5. If the side of the sample media to be analyzed is not apparent, then mark the non-active side of the sample.

NOTE 1: *Samples submitted for total alpha/beta activity analysis must be thin, flat, and dry (e.g. smears and air filters).*

NOTE 2: *Suspect nuclides must be alpha emitters or beta emitters with maximum beta energies > 200 keV.*

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3.26 Isotopic Analysis Samples

Isotopic Analysis Samples

1. If submitting tritium or nasal smears for isotopic analysis, then contact HPAL for preparation instructions.
2. Remove any portions of the sample that are known not to have activity present. For example, remove sections of an LAS or PPE item with no activity.
3. Prior to packaging, perform a field screening measurement of the sample to determine the estimated activity.
4. Verify each sample is less that 70 mm (2.75”) at its greatest dimension, or is easily compacted to this size.
   - If the sample cannot be reduced to this size, then contact HPAL
5. Package samples for isotopic analysis in individual bags and mark each bag individually for identification (number).

NOTE 1: *Samples submitted for isotopic analysis include smears, air filters, liquids, oil, charcoal filters, PPE, etc.*

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3.27 Liquid Scintillation Samples

Liquid Scintillation Samples

1. Mark each LSC sample vial or other container individually (e.g., number).
   - Do not mark directly on smears or filters
   - Do not write on the side/bottom of the LSC vial, only write on cap
2. Ensure LSC vials are not leaking.
3. If submitting an oil sample, then provide at least 5 mL of oil.
4. If submitting a water sample, then provide at least 10 mL of water.

NOTE 1: *Leaking samples will be returned to the submitter unanalyzed.*

NOTE 2: *Sample types appropriate for LSC must be soluble or become transparent in the LSC cocktail. These include tritium smears, nasal smears, water samples, light colored oil samples, etc. Bulk samples **cannot** be analyzed by LSC. Acidic or basic (pH <5 or pH >9) samples **cannot** be accepted for LSC analysis.*

NOTE 3: *Suspect nuclides appropriate for liquid scintillation analysis include alpha emitters, low-energy beta (max. energy <200keV), and low energy photon (< 15keV) emitters.*

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3.28 Source Standardizations

Source Standardizations

1. Leak check sources prior to submittal. Leaking sources will not be standardized by HPAL.
2. Identify nuclide(s) associated with each source on the submittal form.
3. Package and transport source standardization samples in accordance with RP-PROG-TP-203, *Packaging and Transporting Requirements for RP Activities.*

NOTE 1: *Sources requiring standardization include instrument calibration and check sources where knowledge of the true activity is required. Response check sources used only for their emission rate relative to a previous measurement normally do not require standardization.*

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3.29 Leak Test Samples

Leak Test Samples

1. Collect and package leak test samples for analysis in accordance with applicable preparations sections, and the analysis guidance in Table 1.
2. Identify nuclide(s) associated with each source on the submittal form.
3. If the source is an accountable sealed source, then obtain the RSSDMS ID number for inclusion on the submittal form.

Radiation Type	Sample Type	Analysis
Alpha AND ≥ 200 keV Beta	Smear (NuCon)	Total Alpha/Beta
	Swab	Liquid Scintillation
Gamma only	Smear/swab	Isotopic
Low-Energy Beta (< 200 keV) AND Low-Energy Gamma (<1 15 keV)	Tritium smear/swab	Liquid Scintillation

Table 1

NOTE 1: *Leak test samples include smears taken from sources for leak-testing purposes.*

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